

DETECTING ORGANIC MOLECULES ON THE SURFACE OF INORGANIC DUST
PARTICLES USING AEROSOL MASS SPECTROMETRY

by

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ABSTRACT

Detecting Organic Molecules on the Surface of Inorganic Dust Particles Using Aerosol Mass Spectrometry

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Detection of organic molecules present on the surface of dust particles is important in homeland security, agriculture, and several other applications. The research presented reports the ability of the aerosol mass spectrometer (AMS) to detect molecules on the surface of dust particles without detecting the particle core.

Experiments were carried out to detect semi-volatile organic compounds adsorbed onto the surface of particulates without interference from the dust particle core. Methyl salicylate, oleic acid, and organophosphorus pesticides such as Malathion were detected on the surface of particles representative of dust-type materials. Zeolite powders were used as aerosol support, representative of a typical silica mineral aerosol present in the atmosphere. Mass spectral fingerprint information was gained by first directly detecting atomized species to record their clean electron impact mass spectrum. This facilitated detection during later experiments of organic molecules coated on an inorganic support.

Spectra obtained give mass spectrometric signatures of molecules coated on inorganic particles without detection of the particle core.

An important feature of the AMS is the ability to equate an ion rate detected in the mass spectrometer to a mass concentration of a given chemical species in a sample using its ionization efficiency. Based on an average inlet flow rate of $1.2 \text{ cm}^3 \text{ sec}^{-1}$, the ionization efficiencies obtained were 5.89×10^{-5} , 1.15×10^{-6} , and 1.62×10^{-5} for Malathion, methyl salicylate, and oleic acid, respectively. These experiments and the results obtained show that detection and characterization of organic species adsorbed onto inorganic dust particles are possible at $\mu\text{g m}^{-3}$ concentrations using the AMS.

(93 pages)

DEDICATION

My Lord and Savior Jesus Christ, the author of life itself, without whom life would have been an unending search for meaning and the beloved memory of my dad.

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CONTENTS

	Page
ABSTRACT	iii
DEDICATION.....	iv
ACKNOWLEDGMENTS.....	vi
LIST OF TABLES.....	x
LIST OF FIGURES.....	xi
CHAPTER	
1 INTRODUCTION	1
1.1 ATMOSPHERIC PARTICULATE MATTER.....	1
1.2 ORGANIC CHEMICALS IN THE ATMOSPHERE.....	3
1.3 PESTICIDES.....	4
Uses of Pesticides.....	6
Characteristics of Pesticides.....	6
Organophosphorus Pesticides.....	10
Environmental Fate of Pesticides.....	12
Transport in Spray Drift.....	12
Transport in Air.....	15
Transport in Particles, Including Dust.....	16
Partitioning, Transport and Deposition Processes.....	16
Health Effect.....	17
1.4 THESIS OVERVIEW.....	20
2 MEASUREMENT APPROACH USED IN THE AERODYNE AEROSOL MASS SPECTROMETER (AMS).....	22
2.1 REAL-TIME ATMOSPHERIC PM INSTRUMENTATION.....	22
Existing Instrumentation for Measuring Organics.....	23
Aerosol Time-of-Flight Mass Spectrometry.....	23
Ion Mobility Spectrometry.....	25
Gas Chromatography.....	28
Fourier Transform InfraRed Spectroscopy.....	29

	Mass Spectrometry.....	30
	2.2 THE AEROSOL MASS SPECTROMETER.....	32
	Overview.....	32
	Modes of Operation.....	35
	2.3 THEORY OF AMS QUANTITATIVE MEASUREMENTS.....	37
	2.4 AMS OPTIMIZATION.....	43
	2.5 DATA ANALYSIS TECHNIQUES.....	45
3	INVESTIGATIONS INTO ADSORBED ORGANIC MOLECULES ONTO INORGANIC PARTICLES.....	46
	3.1 EXPERIMENTAL SET-UP.....	46
	3.2 MATERIALS USED.....	52
4	RESULTS AND DISCUSSION.....	55
	4.1 AMS MASS SPECTRUMS OF ATOMIZED METHYL SALICYLATE AND MALATHION.....	55
	4.2 MASS DISTRIBUTION OF ATOMIZED METHYL SALICYLATE AND MALATHION.....	57
	4.3 COMPARISON OF AMS SPECTRA OF METHYL SALICYLATE AND MALATHION WITH NIST DATABASE.....	60
	4.4 ADSORPTION OF ORGANICS ON MINERAL DUST.....	63
5	SUMMARY AND CONCLUSIONS.....	70
	5.1 SUMMARY OF THE OBJECTIVES AND EXPERIMENTS.....	70
	5.2 FUTURE WORK.....	71
	REFERENCES.....	73
	APPENDICES.....	82
	APPENDIX A: Ionization Efficiency for methyl Salicylate, Oleic acid and Malathion.....	83
	APPENDIX B: Mass concentration and Detection limits calculations.....	89
	APPENDIX C: Mass distribution for polystyrene latex (PSL) and PSL coated with Malathion.....	93

LIST OF TABLES

Table	Page
1. Volatility Class of Pesticides.....	10
2. Organophosphates Mammalian Toxicities (mg/kg of body weight).....	12
3. Selected Physicochemical Properties of Malathion.....	53
4. Selected Physicochemical Properties of Methyl Salicylate.....	54
5. Selected Physicochemical Properties of Oleic Acid.....	54
A-1. Tabulated Results for Methyl Salicylate Ionization Efficiency.....	85
A-2. Tabulated Results for Oleic Acid Ionization Efficiency.....	86
A-3. Tabulated Results for Malathion Ionization Efficiency.....	87
B-1. Tabulated Results for Mass Concentration and Detection Limits.....	90

LIST OF FIGURES

Figure	Page
1. Schematic showing the particle beam interface and particle sizing region joined to the mass spectrometer region of the field portable instrument. (Eric et al., 1997).....	25
2. The principle and the schematic diagram of an ion mobility spectrometer (Jorg et al., 1999).....	28
3. Chemical structure of nerve agents a) Sarin, b) Soman, c) Tubun, and d) VX.....	31
4. Chemical structures of two common insecticides: a) Diclorvos, and b) Phosdrin.....	31
5. A picture of the Aerodyne aerosol mass spectrometer (AMS).....	34
6. Basic Schematic of the Aerodyne aerosol mass spectrometer (Jayne and Leard, 2000).....	35
7. Schematic of the AMS vaporization and ionization region (Jimenez et al., 2003).....	36
8. Electron impact ionization cross section as a function of the number of electrons in a molecule for various inorganic and organic compounds (Jimenez et al., 2003).....	40
9. A picture of the Wright dust feeder.....	47
10. Schematic diagram of the historical Wright dust feeder from original publication (Wright, 1950).....	48
..	
11. Schematic of a ‘Vienna design’ differential mobility analyzer (Winklmayr et al., 1991).....	49
12. Experimental set-up.....	51
13. Schematic diagram of experimentation set-up.....	52
14. Mass spectrum of atomized methyl salicylate (y-axis in arbitrary units).....	56
15. AMS mass spectrum of the Malathion.....	57

16. Mass distribution of atomized methyl salicylate particles (y-axis in arbitrary units)..	59
17. Mass and number distribution of atomized Malathion sample using AMS TOF mode.....	60
18. Methyl Salicylate comparison with NIST methyl salicylate.....	62
19. Malathion comparison with NIST Malathion.....	63
20. Oleic acid comparison with NIST oleic acid.....	63
21. Mass spectrum of zeolite dust.....	64
22. Mass spectrum of zeolite dust coated with Malathion.....	65
23. Difference mass spectrum between 21 and 22.....	65
24. Mass Spectrum of dust coated with oleic acid.....	66
25. Mass distribution of coated MES on zeolite dust using the same two m/z ratios.....	67
26. Mass distribution of coated Malathion on zeolite dust.....	68
27. Mass distribution of coated oleic acid on zeolite dust.....	68
A-1. Ionization efficiency for methyl salicylate.....	85
A-2. Ionization efficiency for oleic acid.....	86
A-3. Ionization efficiency for Malathion.....	87
A-4. Ionization efficiency for ammonium nitrate.....	88
C-1. Mass distribution for Polystyrene Latex (PSL) and PSL coated with Malathion.....	93